REPORTS OF THE SPRING VALLEY HYDRAULIC GOLD COMPANY

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REPORTS

ON THE

SPRING VALLEY

HYDRAULIC GOLD COMPANY

COMPRISING THE

CHEROKEE FLAT BLUE GRAVEL

AND

SPRING VALLEY

Mining and Irrigating Company's Property.

BY R. H. STRETCH, M. E.,

AND

CHARLES WALDEYER, M. E.

SITUATED AT

CHEROKEE FLAT, BUTTE COUNTY,

CALIFORNIA.

MENLO PARK, N. J.,
December 20th, 1879.

EDWARD BATES DORSEY, ESQ.,
President,

SIR:

I have read with care the report of R. H. Stretch, M. E., upon the properties of "The Cherokee Flat Blue Gravel," and "The Spring Valley Mining and Irrigating" Companies, the result of a most careful investigation by him during a period when I was investigating the same properties, at the instance of and under instructions from Prof. T. A. Edison; and can state, that not only all that is embraced in said Report (except perhaps platinum in the quantity named therein, which I consider too great) is justified by the facts with which I am cognizant, but I am confident, that had the former proprietors of these properties been possessed of the information now obtained of the process applicable to the saving of *all* the Gold, and other metals found in this auriferous deposit, much larger net returns would have been shown on the books of the Companies, than are indicated in the report; and further, I am persuaded that if the Cherokee Flat Blue Gravel Co. had been possessed of the water facilities hitherto afforded to the Spring Valley Mining and Irrigating Co., far greater net returns would have been shown from the same area of ground sluiced from their property, by reason of such being on the deeper and richer part of the channel of this auriferous deposit. In further assurance of my opinion of the great value of these properies as now consolidated, I may say that "The Edison Ore Milling Co.," are willing to make a contract for 15 years, which I would willingly advise should be twenty-five, to take all the tailings from these properties, (now being and all those that have hitherto been thrown away), and return to the proprietors of these properties one-half of the gross yield of Gold and Platinum extracted therefrom.

I am respectfully yours,

FRANK McLAUGHLIN.

EDWARD BATES DORSEY, ESQ.,
President U. S. Mining Investment Co.,

SIR:

From my own investigation of the subject referred to in the letter to you from my agent, Mr. F. McLaughlin, covering a period of several weeks (receiving from him during that time large quantities of the sands and gravel for treatment at my laboratory), and from my knowledge of his ability and experience in such matters, I fully endorse him as worthy of the utmost confidence,

Respectfully yours,

THOMAS A. EDISON.

NOTE.

A contract for 15 years has been made with Thomas A. Edison as representative of the "Edison Ore and Milling Company," to work the tailings and debris, which has hitherto gone to waste, by which the SPRING VALLEY HYDRAULIC GOLD MINING COMPANY will receive one-half of all the precious metals and minerals saved free of charge.

EDWARD BATES DORSEY, Esq.:

SAN FRANCISCO, October 10, 1879.

Dear Sir:

In accordance with your instructions, I have made a careful examination of the property of the Cherokee Flat Blue Gravel Company, and of the Spring Valley Mining and Irrigating Company, situated north of Oroville, in Butte county, State of California, and have the honor to report as follows: My investigation has extended over a period of ten days, and the conclusions drawn are based, not upon speculation, but upon actual ascertained facts. I shall treat both properties as a unity in this report.

Yours respectfully,

R. H. STRETCH, *M. E.*

REPORT

ON THE

CHEROKEE FLAT BLUE GRAVEL, AND SPRING VALLEY MINING AND IRRIGATING CO.'S PROPERTY,

SITUATED AT

CHEROKEE FLAT, BUTTE COUNTY, CALIFORNIA.

Having, in previous reports, given a very full and complete account of hydraulic mining operations in California, I shall not burden these pages with a repetition of the same.

The relation of the mines to the gravel deposit, of which they are a part, is shown in map No. 2, in which the yellow shading shows the known extent of the gold bearing gravel, the green line the Rimrock, or point where the solid rock which underlies the gravel comes to the surface, and the grey shading the basalt or lava cap which overlies the gravel, leaving visible a portion of the gravel

where it has been broken away. An examination of all the surroundings affords abundant evidence that the old river channels used to run through the Spring Valley, Cherokee Flat Blue Gravel and the Hendricks' mines, with a grade of about one hundred feet to the mile, so that the deepest depression or main channel will be found in a position very nearly represented by map 3, which shows the ground under consideration on a still larger scale.

Map 3 shows the ground of the Spring Valley Company (colored red), also the ground of the Cherokee Flat Blue Gravel Mine (colored green), with the local roads, reservoirs, &c. The Hendricks' track of 5 31-100 acres, is not included in the company's property. The total area of the ground owned by the Spring Valley Company is 322 32-100 acres: of this about 100 acres has had the top gravel removed, the shape of this portion being indicated by the sinuous brown line, and about 40 acres are unavailable for hydraulic purposes on account of the heavy lava cap (marked sugar loaf), so that there is an available area for hydraulic purposes of about 180 acres of gravel which has not been touched, and 100 acres partially worked.

The Cherokee Flat Blue Gravel Company owns about 893 acres of ground, of which about 200 acres is available for hydraulic purposes, and the balance can only be drifted on account of the heavy lava cap.

A clear title can be given to the whole of this land, aggregating 1,215 32-100 acres.

WORK DONE ON THE CLAIMS.

In 1856, the Cherokee Flat Blue Gravel Company started a deep bedrock tunnel to open their ground as a drifting claim, and pushed the work ahead until June, 1863, when the tunnel was in a distance of 1,542 feet, and work was stopped. When resumed, in the spring of 1867, an incline was started almost directly above the end of the old tunnel, and in May, 1870, had penetrated the hill about 800 feet, following the bedrock, and proving the existence of what is known as the blue lead under Table Mountain. The incline was very wet and suffered severely by the heavy blasts in the adjacent workings of the Spring Valley Company, so that it had to be abandoned, and from that time no work has been done on the claim.

Before the consolidation of the Cherokee and Spring Valley

claims, they had each been worked in a small way by small streams of water with low pressures, but after the consolidation, extensive water-works were planned and built, and since February, 1873, the daily supply of water has been 2,210 inches, equal to nearly nine million cubic feet; as a natural consequence, the company at once produced excellent results, a synopsis of which is given below. The Spring Valley ground was opened by the Welch and Eureka Tunnels, neither of which permit the working of the bedrock, so that there yet remains a stratum of gravel, varying from 5 to 40 feet thick over the entire ground which has been worked, and as the bedrock pitches southwest into Table Mountain, the thickness of this untouched bottom gravel increases steadily as work progresses south, up Saw Mill Ravine.

QUALITY OF THE GRAVEL.

The total area of ground worked by the Cherokee and Spring Valley Companies, has been about 100 acres in a period of from 25 to to 30 years, while the production of gold has been about as follows:

From 1849 to February 15, 1871, say twenty years, at $150,000	$3,000,000 00
February 15, 1871, to February 23, 1873	253,527 01
February 23, 1873, to August 9, 1879. (See statement)	2,185,634 39
	$5,439,161 40

From which it results that the yield per acre has been $54,491 61.

It is not easy to say, in the absence of definite data, what has been the variation in the quality of the gravel in the different portions of the mine, but an average value per cubic yard of the whole mass worked, is easily obtainable; at the rate of 54,491 61-100 per acre, one square yard would yield $11 25, which for an average thickness of 40 yards (120 feet), is 28 cents. per cubic yard.

It should, however, be remembered, that this result does not include the dark green and blue gravel left in the pit, which, we have previously seen, have an average thickness, say of six yards. These are the richest gravels in the claim, and are worth on the average of $5 per yard.

In the Eastern portion of the works, the coarse gravel is rich in gold; so rich, in fact, that the Spring Valley Company keep quite a force of men employed upon it at a very heavy cost. Thirty-two

pounds of the blue gravel, taken on the line between the Spring Valley and Cherokee Flat claims, gave me 64 cents, equal to two cents per pound, $40 a ton, or $70 a yard. A long series of pannings on the same gravel, including also samples from the rotten boulder streak, and some of the top gravel which had caved down, gave me an average of 4 cents to the pan, which is equal to about $6 per ton, or $10 50 per yard. The estimate of $5 per yard for this lower gravel, is certainly very safe. As it is about 6 yards thick, its average value per square yard would be $30, which, added to $11 25, the actual value of the ground already washed, makes $41 25 as the value of one square yard from the surface to bedrock, which, for a thickness of 46 yards (138 feet), would give 89 cents as the approximate value per cubic yard.

From the above facts I deem the following to be a fair estimate of the gold in the property :

180 acres of Spring Valley hydraulic ground, at $50,000 per acre	$9,000,000
100 acres of bottom gravel, at $145,000	14,500,000
200 acres of Cherokee F. B. Gravel hydraulic ground, at $60,000	12,000,000
3,300 yards long by 500 wide by 2 high, for drifting ground on C. F. B. G., 3,300,000 yards at $10	33,000,000
	$68,500,000

In this estimate I place the hydraulic ground of Cherokee Flat Blue Gravel Company at a somewhat higher rate than that belonging to the Spring Valley Company, because it appears to be nearer to the main channel.

The dimensions of the drifting channel were obtained by measurements on the ground. Result of the past operations of the Spring Valley Company. The following is an instructive table :

Year.	Gross Product'n	Expenses.	Profits.	Dividends.
July, 1873	$130,164 14	$30,713 97	$99,450 17	$50,000
" 1874	476,112 23	125,877 79	350,234 44	100,000
" 1875	401,599 91	149,638 46	251,961 45	85,000
" 1876	406,891 74	147,057 29	259,834 45	80,000
September, 1877	335,376 00	153,548 00	181,828 00	50,000
October, 1878	314,203 35	137,429 25	176,774 10	100,000
Five years nine months	$2,064,347 37	$744,264 76	$1,320,082 61	$465,000
Yearly average	359,016 93	129,437 33	229,579 43	

This table requires some comment. The discrepancy between the amount of profits and dividends is accounted for by the fact that the company have purchased lands to the extent of over $500,000, and mining claims to the amount of $407,084 92, besides paying for the construction of the water works, a sum of over $423,000; nearly the whole of these large sums having been taken out of the mine.

The decrease in the yearly production is due solely to the fact that year by year they have been working a larger and larger proportion of top gravel, on account of their inability to reach the bedrock. In the attempt to do this, the grade of the flumes has been diminished, thus lessening their carrying capacity, and involving an increase in the labor account. This defect can be remedied by the construction of a deeper bedrock tunnel, which would have a length of 6,000 to 7,000 feet, and cost $200,000, but which is not necessary if the two claims are consolidated.

As the claims stand to-day, they merely require the completion of the Cherokee Flat Blue Gravel deep tunnel to put them in first class condition. This tunnel is one hundred feet below bedrock, where it will strike the channel, and requires to be run six hundred feet, to the first upraise. The last eight hundred feet is constructed on a sluice grade of four feet to the one hundred feet, while the first seven hundred feet will have to be cut down five feet at the mouth to bring it to the same grade. The whole tunnel will have to be enlarged from 5x7 feet to 9x9 feet square, so that the modification and enlargement will cost as follows:

Change of Grade, 324 cubic yards, at $3	$ 972	
Enlargement, 2,695 " 3	7,965	$8,937 00
New work will cost:		
The excavation of 600 feet of new tunnel (full size) to first raise into gravel would cost, according to the actual figures of other similar works (see experience of North Bloomfield Co., etc.), about $22 per running foot, or 600 feet at $22		$13,200 00
Preparation of track or flume in bed of tunnel, 2,142 feet at $2		4,284 00
Raise into gravel, say 90 feet at $10		900 00
Side branch into main diggings, for hydraulic purposes, say 400 feet at $24		9,600 00
Raise into hydraulic diggings		900 00
Construction of flumes and under-currents		5,000 00
Extension of Flea Valley Ditch, to work, say 2 miles, at about 75 cents a foot		7,500 00
Air pipes in tunnel		1,636 50
		$51,957 50

This work would take twelve months, allowing a monthly progress of one hundred feet, and would make the tunnel available for hydraulic purposes at the beginning of the second fiscal year. To prepare it for drifting purposes, two hundred feet more of bedrock tunnel can be pushed ahead at a cost of $4,800, and about one thousand feet of lateral openings made into the gravel at a cost of $1,500. With these data we are able to furnish an estimate of the results for the first year after consolidation :

800,000 inches of water used, washing 4 yards of gravel, worth 10 cents a yard	$320,000	
1,000 yards of drift gravel washed, at $10	10,000	—$330,000
Cost of hydraulic mining, at 25 per cent	$80,000	
Cost of main tunnel for hydraulics	51,957 50	
Cost of main tunnel for drifting	6,300	—$138,257 50
		$191,742 50

This result will be obtained by washing the top dirt on the ground of the Cherokee Blue Glavel Company, which we know is worth from five to fifteen or twenty cents per yard, thus avoiding the great expense of handling the bottom dirt by which expenses can certainly be reduced from thirty-three to twenty-five per cent., and all the necessary appliances are in place as shown in the plan of the flumes and air-pipes hereto attached. The results for the second year are such that I almost fear to state them, although I can find no reason to doubt their accuracy after canvassing them repeatedly. In this year the income would be from three sources, entirely independent of each other, and the working of which would in no manner clash, viz.: from drifting, from washing the high bank, and from working the bottom gravels left in the old works. Let us look in the first place at each proposition by itself. To estimate the drifting proposition; certain dead work must be done, viz.:

The main tunnel should be run ahead 400 feet, at a cost of $24 per foot, say	$9,600
The upraises into the gravel can be made at a cost of	1,800
Lateral drifts in gravel, say 2,400 feet, at $1 50	3,600
Total dead work	$15,000

The mine could employ forty stopers during the year, which with carmen, drifters, timbermen, etc., would make an average force of say eighty men at $3 per diem. These stopers can take out four yards daily to the man, or one hundred and sixty cubic yards daily. (I find that, on contract work, men have taken out as

high as eight and one-third yards daily in this gravel, at seventy-five cents a yard, finding their own carmen.) All the gravel would be washed in the main flume, from the hydraulic works. We have, therefore, as a result of drifting operations as follows, using the minimum value of the gravel and the minimum result of the labor:

160 yards gravel daily for 300 days, equals 48,000 yards, at $10		$480,000
Note 1-70 of the drifting ground, 80 men at $3, $240, for 300 days	$72,000	
Timbering	60,000	
General repairs of all kinds	10,000	
Candles, powder, steel, tools, lumber, etc	10,000	
Dead work, as above	15,000	$167,000
		$313,000

For the hydraulic operations on the high bank there will be an opportunity to reach bed rock, and treat the bottom gravels along with the top ones, and better results may be expected than have been previously obtained. The average value of an inch of water for six years has been forty-two and one-half cents, while the average value of the gravel per cubic yard has been twenty-eight cents. With the bottom gravel included in the bank, it is very safe to say that the yield per inch will be increased and range fully up to seventy or seventy-five cents per inch, which is only one-half of the theoretical figures. If we set aside 100,000 inches of water to be used on the unworked bottom, we shall have as the high bank result:

700,000 inches of water at 70 cents per inch	$490,000
Less expenses, 25 per cent	122,500
	$367,500

By reference to page eight it will be seen that this was about the result in 1874, and with the additional facilities provided there can be no doubt of the ability of the mine to produce and maintain these figures, which represent a production for forty years. We have still left the unworked bottom on the old ground, which has a value of some $145,000 per acre. The income from this depends solely on the number of men employed.

An acre per annum might be cleaned up at a cost of, say, $45,000, or 33 per cent., leaving a margin of $100,000. The total result would be as follows:

Net income from drifting operations	$313,000
" hydraulic "	367,500
" cleaning up "	100,000
	$780,500

And there is no element of uncertainty about any of these figures except the first. These figures are substantiated by the results of these claims in their actual returns, by the experience of other mining enterprises of a similar character, and by very careful examination of the ground, they can be substantiated and maintained for many years.

Appended to this report you will find a statement of each "clean-up" made by the Spring Valley Company since the water works were completed: a complete schedule of the property included in the proposed transfer; a sketch of the appearance of the gravel bank along the line between the two claims, etc.

As in all hydraulic enterprises an abundant water supply is all important, a glance at those constructed by the Spring Valley Company may not be out of place; as will be seen by the schedule of property, there are nearly 100 miles of ditch and pipes, all in excellent repair, giving a steady supply of 2,210 inches at the discharge gate of the Concow Reservoir, and the supply has been maintained without drawing upon the Round Valley Reservoir at the extreme northern end of the works, so that the capacity of the works may be safely set down at 800,000 inches per annum delivered by Concow Reservoir, without reckoning the local winter supply. I have, therefore, assumed the capacity of the works at the above figures. The reservoirs near the mine are numerous, and so located as to be out of the way of future mining operations. For the use of the machinery for drifting purposes, the water of the Flea Valley ditch can be brought in and had at a nominal cost, say $50 monthly. Ample allowance is made for this extension in the estimates.

As the so called "debris" question is one of vital importance to all hydraulic mines at the present time, it is only right to state that ample provision has been made by the Spring Valley Company to avoid conflict with the farming interests from this source. About 3,680 acres of land lying along the bed of Dry Creek, and including the whole of the river bottom to the bluffs on either side, go with the property, the whole of which is available as a dump for tailings,

without risk or expense. I examined all this ground which is shown on map. The track is large enough to accommodate the debris of 200 acres of deep hydraulic ground, and yet not be covered to a depth of 20 feet. The possession of this land and also the right of way down to the main river, effectually disposes of the debris question, so far as the property under consideration is concerned.

It may also be of interest to state that at the time of my visit, Major McLaughlin, on behalf of Professor Edison, the celebrated electrician, was devoting his time to an investigation of the platinum question. His stay at Cherokee extended over two weeks, and resulted in the discovery of this metal in abundance, so that it may be probably a source of revenue in the future, to the extent of $20,000 to $30,000. I have not, however, laid any stress on this point in my estimates. Incidentally his presence was of great importance to me, as the constant prospecting of platinum, in which alone he had an interest, resulted in the same show of gold in every pan which I had personally found, and many of his prospects greatly exceeded my own.

He also discovered the fine sands to contain innumerable small, microscopic diamonds, and it is not unlikely that the process through which the black sands would have to be passed to eliminate the platinum, would result in the discovery of many valuable stones; no search is made for them, yet they are not unfrequently picked up; one was found while I was on the ground, which, if cut, would have a value of about $75 to $80.

In conclusion, I may say that the statements here made can be readily verified; whatever argument may be used against each property separately, there cannot be one urged against the consolidated interests.

Yours respectfully,

R. H. STRETCH, *M. E.*

APPENDIX.

Since my arrival in New York, I have learned a few additional facts which may be of interest.

Samples of the black sands which are collected in the flumes in large quantities, were sent to Mr. Edison for examination, to see if they contained platinum; each of these samples consists of 25 lbs. One was the sand just taken from the flume after extracting the amalgam, the other the same material after it has been passed through a small pan and partially ground. The results were $1,750 and $840 per ton of 2,240 lbs., in gold, respectively. These results show that the sands may probably be made a source of considerable profit. To secure them in quantity merely requires a little more labor in cleaning up, the additional cost being inconsiderable.

I am also in receipt of information from the Spring Valley Company, dated October 30th, that up to that time 800 lbs. of amalgam, worth about $80 a pound, had been sent up to the office, and that the men were then engaged in cleaning up the Eureka Tunnel. The amalgam to Oct. 20th being worth about $64,000 or upwards, it is probable that the total clean-up will aggregate $90,000, if not more, as the last clean-up was on Aug. 9; this is the result of two months and ten days work, equal to about $1,285 daily, or at the rate of $460,000 per annum. This result was largely due to the employment of a large force of men to wheel the bottom gravels into the flumes, and is good evidence in support of the position taken in the main report.

It will, of course, be understood that the company going into possession will be making an income immediately, everything being in complete running order.

R. H. STRETCH, *M. E.*

New York, October 30th, 1879.

STATEMENT OF BULLION YIELD

OF THE

SPRING VALLEY MINE,

From the Consolidation of the Cherokee and Spring Valley Mines in 1873 *to date.*

Year.	Date of Clean-up.	Total Yield.
1873	February 20	$6,689 60
	March 21	25,471 78
	April 5	12,409 92
	May 9	23,599 94
	June 4	29,645 05
	June 16	15,566 18
	August 9	8,366 49
	September 11	40,855 50
	October 20	71,273 15
	November 24	60,201 71
	January 9	32,617 94
		$326,697 26
1874	February 22	72,256 87
	April	43,808 32
	April 6	40,899 99
	May 11	19,343 36
	May 25	26,556 02
	July 8	18,935 46
	July 15	40,997 42
	August 4	25,431 54
	September 23	13,731 81
	November 2	57,441 97
	November 6	363 92
	December 22	60,616 19
		$420,382 68
1875	February 12	60,436 62
	March	9 87
	April 16	72,526 44
	May 18	47,854 59
	July 15	63,290 54
	September 3	14,054 43
	October 18	19,842 37
	November 9	21,944 39
	December 10	10,043 44
	November 5	2 433 39
	December 20	11,148 10
	January 4	30,191 64
		$353,775 82
1876	February 18	$11,984 98
	March 3	60,505 11
	April 3	23,668 34
	" 11	5,659 28
	" 18	22,432 03
	" 25	27,001 10
	" 28	28,998 77
	June 5	57,738 15
	July 17	59,256 22
	September 23	33,221 83
	November 28	33,590 13
	December 4	15,143 93
	January 20	21,092 77
		$400,292 64
1877	February 10	11,589 12
	March 13	11,785 91
	April 10	22,150 87
	May 4	25,255 11
	June 18	59,945 26
	July 31	17,990 15
	August 3	32,319 41
	September 15	51,291 51
	December 3	34,180 24
	January 3	26,472 63
		$292,980 21
1878	March 8	24,179 10
	March 25	22,489 20
	May 27	13,213 64
	June 7	32,261 61
	August 7	21,358 87
	October 29	49,863 05
	January 1	90,185 01
		36,701 40
		$290,251 88
1879	February 1	12,000 00
	May 9	51,728 62
	August 5	37,525 39
	October 23	86,900 00
	Total	$2,272,534 69

SCHEDULE OF PROPERTY

Belonging to the Spring Valley Mining & Irrigating Company.

MINING CLAIMS.

Land included in patent	319 89-100 acres
Kerr & Green claim	2 43-100 acres
28-40 Wild Yankee	6 43-100 acres
Total	328 75-100 acres

Large claim on Butte Creek (value uncertain); land purchased to provide dump for tailings, about 3,680 acres.

RESERVOIRS.

Concow, which covers 210 acres, and cost $70,576 93; Round Valley, area 160 acres, cost $8,370 65; also Grub Flat, Littlefield, Hutchinson, Tom Jones, Glass, Spring Valley, Campbellfield, and Table Mountain, 10 acres.

DITCHES.

Dewey & Miners, 5x5, 30 miles; Butte Creek to Concow Reservoir, 25 miles; with 1,060 feet 30-inch pipe at Little Butte Creek, and 3,780 feet 30-inch pipe at the west branch of the North Fork, size 8x5x3; Fall Creek Ditch, 4x3, 2½ miles; Concow Reservoir, to Cherokee, with 13,100 feet 30-inch pipe across west branch, and 3,839 feet of 30-inch pipe to Grub Flat Reservoir, 16 miles; Oregon and Table Mountain Ditch, 17 miles; Irish Ditch and Reservoir, 6 miles. Total, 96½ miles.

TUNNELS.

Welch, Eureka and Cherokee equipment of claims. 30,480 feet of 4, 5, 6-feet flumes; 20 under currents; 16 giants; 2 derricks; 12 gates and distributors; 5,000 feet 22-inch pipe; 2,500 feet 15-inch pipe.

BUILDINGS, ETC.

Stone office; store; barn; blacksmith shop; lumber shed, and sundry small buildings in the pit.

TELEGRAPH LINE.

Cherokee to Oroville, connecting with lines of the Western Union, say twelve miles, with complete outfit.

GENERAL SUPPLIES.

Quicksilver, about 6 tons; 60 tons hay; 500 sacks barley; 2 wagons; 4 horses; lumber; iron; steel; powder; fuse; tools, and a full line of everything required in the works.

REPORT.

[This is the official report made eight years ago to the board of directors of the Cherokee Flat Blue Gravel Company for their personal use and guidance.]

To the President of the Cherokee Flat Blue Gravel Co.

SIR:

Having been requested by you to make an ample and correct report of all matters pertaining to the property of the Company, I hereby submit the following, trusting it will have your approval.

CHEROKEE, Butte Co., Cal., Oct. 3, 1871.

Respectfully your ob't serv't,

CHARLES WALDEYER,

General Superintendent.

THE BLUE LEAD.

Amongst the great gravel deposits of California, the "BLUE LEAD" has attracted the greatest attention. Not only its position, which is immediately upon the "bed rock," but also its color, varying from a dark green to a bright indigo color, prove it to be the *oldest gravel deposit* on the Pacific coast.

Its color evidently resulted from the substratum of "bed rock," the grinding away of which afforded the pigment to dye the quartz and other debris, and the sulphurets of iron, by a chemical change, assisted in making this color "fast."

It is hardly reasonable to ascribe the creation of the "blue lead," and the gravel deposits overlying it, merely to the action of water, and we must call to assistance the

GLACIAL MOTION THEORY

of Professor Agassiz.

Before entering upon the above mentioned task, it will be necessary to inquire:

How was the quartz, the matrix of almost all the gold found in California, supplied? Can we really believe that enough quartz ledges were destroyed to

cover from fifty to a hundred square miles with nothing but quartz gravel and quartz sand from two to three hundred feet deep?

Would all the known quartz ledges of California, rising from unknown depths, even ten times higher than Mount Blanc, have been sufficient to furnish one ten-thousandth part of the quartz gravel deposits now found in this country?

After considerations like the foregoing, it must become evident to the investigator, that the quartz before ground into pebbles and sand, existed in huge masses, and in such a position that any great grinding force, or power of attrition, could be applied more or less directly to it.

This point agreed upon, will it not be an easy task to account for the existence of quartz in enormous masses, covering the hillside and filling the vale? Adopting the theory that the quartz in a molten state was forced from the bowels of our globe, through fissures in its crust, to the surface, we must come to the conclusion that, as long as the expelling force lasted, the flow of molten quartz would continue, not only filling the fissures to the surface, but pouring in a broad sheet over the lips of the fissure, and seeking, like molten lava or any other fluid matter, its level.

Here then is a source for quartz, supplying all wants, for we have made the existing quartz ledges nothing but extinguished craters, belching in bygone ages their golden streams in every direction.

Any other theory about the creation of quartz ledges will do just as well as the igneous, adopted above, for it must be presumed that, even if the fissures, now containing the quartz, were filled from the surface, then there is no reason to doubt that *immensely more silicious matter was on hand than to fill merely the comparatively few fissures*, and we have again enormous deposits of quartz on the surface, waiting for nature's great crushing process.

The Glacial Motion Theory of Professor Agassiz accounts at once for the existence of the great deposits of drift, not only in and near the valleys of our State, but also on the highest mountain tops of the Sierra Nevada.

According to the Professor's theory, immense ice-fields, thousands of feet deep, covered the continents, and commenced at a certain period their slow motion from north to south, crushing and grinding under their immense weight whatever might be subjected to their pressure, or ploughing deep and broad furrows in their onward march; which later, as far as California is concerned, must have formed the channel for those ancient streams, called by a certain writer the "dead rivers of California."

In support of this theory of Mr. Agassiz, who certainly formed it upon a broader basis than the evidences of the physical geography of California, it must be stated that these ancient channels or "dead rivers" of California, now the depositories of the different "blue leads" and their overlying quartz gravel strata;

run all in the same direction, to wit, from north to south, when all the modern rivers of California debouch into the Pacific Ocean to the west.

It must be evident that this "Glacial Motion" was the beginning of the latest thermal change, and that, when the ice had disappeared, immense floods succeeded, washing the crushed "pulp" into channels and streambeds, and filling them to the depth of hundreds of feet, as evidenced by existing deposits.

Whether the views advanced in the foregoing lines are correct or not, will be immaterial; however, they may illustrate that:

1. The great gravel deposits of California are only an accumulation of the same gold-bearing material which is now extracted from the quartz veins.

2. That nature, though in a crude manner, performed the operation of crushing, and facilitated thus the extraction of gold.

3. That gravel mining, under the modern improvements, will be the most extensive, the most lasting, and the most remunerative mining operation carried on in the State.

The great "blue lead" and gravel deposit in Butte County, claiming our particular attention, will be made the object of a careful description.

LOCATION OF THE LEAD.

This deposit occurs under a "Plateau," known as the *Tancow* or Butte County Table Mountain, extending for a distance of about eight miles from Cherokee Flat, in the north, to Thompson's Flat, in the south, having a width of from two to four miles. It is bounded on its western side by the Sacramento Valley, and on the south, east and north by Feather river and its tributaries, the North Fork and West Branch, so that from all sides an ascent of nearly one thousand feet has to be overcome.

Geographically it is situated between 121 and 122 degrees western longitude and 37 and 38 degrees northern latitude, and, according to the United States Land Survey, is covered by Sections 28, 29, 31, 32, 33 of Township 21, north, Range 4, east, by Sections 4, 5, 6, 7, 8, 9, 16, 17, 18, 19, 20, 21, 22, 28, 29, 30, 31, 32, 33, 34 of Township 20, north, Range 4, east, and by Sections 3, 4, 5 of Township 19, north, Range 4, east, Mount Diablo Meridian.

Ever since the earliest days of gold mining in California, the surroundings of the above mentioned "plateau," or table land, offered the richest harvest to the miner.

Every ravine descending from this plateau, or near it, became celebrated for its richness. Cherokee Flat, at its northern point, and Morris' Ravine, near its southern point, yielded their millions to the most primitive applications.

The miner, in those days, was satisfied to find the gold, and inquired not whence it might have come; but when these ravines and gullies, which were

actually nothing but nature's "sluice boxes," had been worked out, then the question arose: Where is the storehouse from which all this gold has been drawn? —and every indication pointed towards the great *Tancow* or Table Mountain.

INTRODUCTION OF WATER.

As the mode of mining improved, and particularly when hydrostatic pressure was employed, known in California as the *Hydraulic Process*, then the peculiar and isolated situation of Cherokee Flat, which justly can claim the richest and most extensive gravel deposit in the State, was seriously felt. It was considered next to impossible to bring living water in sufficient quantities to that place. The only way to bring such water was either from the West Branch, or North Fork, both tributaries of Feather river, and in either way across the chasms formed by these streams, which flow nearly a thousand feet below the level of Cherokee Flat.

Reservoirs and ditches, at the expenditure of hundreds of thousands of dollars, were constructed merely to catch and store away the rainwater during the winter season, and thus the means for two or three months' mining were obtained. The splendid results of these short mining seasons challenged again and again the energies of enterprising men, and several unsuccessful attempts were made to enlist capital in the introduction of living water to these mines. The idea to carry water by means of pipes across chasms of 900 or 1,000 feet vertical depths, startled even mining engineers of note in the United States and England, and their estimates were either so enormous as to costs, or so doubtful as to success, that even the most daring abandoned the scheme.

And thus, up to the early summer of 1870, the mines depended altogether on rainwater, but yielded so largely that a party of San Francisco capitalists, in connection with the Spring Valley Mining Co. of Cherokee Flat, took the matter in hand, and, after six months' labor, a sheet-iron pipe, 30 inches in diameter, discharged in a steady and even flow a thousand inches of water.

This water was taken from some small tributaries of the North Fork, known as "Flea Valley creek," "Camp creek," and the unusual dry season of California lessened the supply of water to about a regular flow of 600 inches for the whole 24 hours. Besides this rather small supply of water, the Spring Valley Canal and Mining Co. had not only difficulties on account of the insufficient depth of its tunnel —a lower tunnel not being finished—but also on account of those constant improvements which an altogether new *modus operandi* generally necessitates; but still this company produced a fraction of over one thousand dollars for every day's washing, which yield will certainly be doubled in the future by the greater supply of water and other signal improvements now under hand.

The enterprise of the Spring Valley Canal and Mining Co., being the most important of the kind in this State, in fact being the first which has overcome a

depression of between 800 and 1,000 feet (such a one being formed by the chasm through which the West Branch flows), deserves nearer description.

The water is carried in a ditch past Yankee Hill to a point on the north side of West Branch, said point being 980 vertical feet higher than the point where the West Branch is crossed, when a sheet-iron pipe receives the water, carrying it down the slope of the mountain to the crossing of the West Branch, and thence up Cherokee Hill to a vertical height of 830 feet, where the water is discharged again into a ditch and carried to the mines for use.

The pipe has a diameter of 30 inches, is over two miles in length, and constructed of the best boiler-iron—the heaviest being $\frac{3}{8}$ of an inch. As the diagram will show, the pipe on the Yankee Hill side is 150 vertical feet higher than the pipe on the Cherokee Hill side, where the water is discharged, so that there is a "head" of 150 feet. The water, however, during its greatest supply and heaviest discharge, never rose more than 50 feet on the Yankee Hill side over the point of its discharge on the Cherokee Flat Hill side, and was then estimated equal to 1,500 inches, miners' measure* (*i. e.*, water discharged under a "head" or pressure of six inches).

I mention this fact to show that a 30-inch pipe would be able to carry any desirable amount of water, provided a similar "head" is given.

The Spring Valley Canal and Mining Co. estimates its expenditure for pipe, ditches, reservoirs, etc., at $300,000, independent of the old works, as tunnels, etc.

The pipe alone is an item of between $55,000 and $60,000 (delivered at the foundry).

The experience so far gained shows that, under ordinary circumstances, and provided that even a moderate supply of water—say one thousand inches—is received for the whole year, one year would be sufficient to clear the whole expenditure of $300,000.

However, the expectations of this company go far beyond the results of its practical experience, for the reason that the gravel deposits increase in richness as the deeper parts of the channel (or those parts farther removed from the rim rock or riverbank) are reached, when particularly the "blue lead" develops finely, yielding from five to fifteen dollars per ton.

Since the Spring Valley Co. lead the way in introducing water to Cherokee and the rich mines of Table Mountain, other companies have commenced similar operations, amongst them "Hendricks & Co.," taking the water from the upper part of West Branch, and carrying the same by ditch and pipe to "Morris' Ravine," a point where the same gravel deposit—entered here at Cherokee from the north-west—is entered from the south-east; proving equally rich and extensive, and

* NOTE.—An inch of water, about $2\frac{1}{2}$ cubic feet per minute, the water that will run out of an opening 1 inch square, or section under head of 6 inches.

proving thus, to the most skeptical, the unbroken continuation of the great "Gravel Lead" under Table Mountain.

Morris' Ravine itself is about five miles below Cherokee Flat and between four and five hundred feet lower, counting from the bed rock exposed in the Spring Valley Co.'s claims to the bed rock in Morris' Ravine, thus showing a fall of one hundred feet per mile to the channel under Table Mountain.

It may here just as well be mentioned that the "rim rock" on the eastern side of Table Mountain is a great deal higher than the "rim rock" on the western or valley side, and that the plateau of Table Mountain itself has a double inclination—one from north to south, evidently due to the natural fall of the old channel, and the other from east to west, very likely due to the fact that, after the Table Mountain was formed, the mountain chain of the Sierra Nevada rose slowly under the many volcanic disturbances to which this country has evidently been subjected, and tilted the Table Mountain from east to west.

The gold found in the deposits under and near Table Mountain is of unusual fineness, averaging from 950–1000 to 990–1000 fine, and vary in size from the finest flower gold, generally contained in the upper gravel deposits, to nuggets weighing many ounces, found on and near the bed rock.

OPENING THE MINES.

In opening the great "Lead" under Table Mountain by expensive tunnels, without actually knowing the depth of the channel or basin in which the richest part of the deposit rests, great risks had to be taken, the more so as only very few places for such tunnels combined the desirable advantages, to wit:

1. Sufficient depth to drain and work the basin under all circumstances.

2. Proximity to the mine, so that a tunnel of moderate length would suffice to operate; and

3. Ample room for all tailings or washings, after the gold was extracted.

The wanting or overlooking of these three requisites, or any of them, has been a source of much unprofitable labor and great expenditure in mining operations on the Pacific coast; nevertheless the desire to travel the shortest road to fortune proved, again and again, stronger than all dearly-bought lessons, and so we have, here at Cherokee, after the expenditure of hundreds of thousands of dollars for tunnels and other "outlets," only one tunnel which combines all the requisites mentioned before. The tunnel belongs to the

"CHEROKEE FLAT BLUE GRAVEL CO."

This company, originally called the "Butte Table Mountain Consolidated Mining Co.," has been since fifteen years in possession of its mining ground, consisting of about one thousand acres, and expended about $160,000 on improvements, such as tunnels, inclines, shafts, reservoirs and machinery.

TITLE TO MINING GROUND.

To wind up the affairs of the Butte Table Mountain Consolidated Mining Co. a "friendly lawsuit" was commenced in the year 1866, before the District Court of the Second Judicial District, at Oroville, Butte Co., Cal., judgment acknowledged, and the property was in consequence, and to satisfy judgment, sold at public auction, at the Court House, Oroville, by the sheriff of Butte Co., to the highest bidder, and was purchased by an agent of the former stockholders of the Butte Table Mountain Consolidated Mining Co., who transferred the same property to the Cherokee Flat Blue Gravel Co., the new style under which the old stockholders incorporated, said incorporation taking place October 19th, 1866, and continuing up to this date, with a capital stock of 650 shares at $100 each, and

Alexander Caselli, Esq., as President,
Henry Pichoir, Esq., as Secretary.

Thus the title is beyond dispute, as the present claimants and their predecessors are the first occupiers of this ground, and have held it in undisturbed possession for over fifteen years, when the laws of limitation of California make two years the period for a legal possession of mining ground.

The improvements of this Company consist of a Tunnel 5 by 6 feet and 1,542 feet long, an Incline some 800 feet long, and some Shafts, Drain Tunnels, Reservoirs, Ditches, etc., of minor importance.

The mining ground, as the map will show, stretches in a south-easterly direction, for 10,000 feet across the Channel or Basin, from "rim to rim," or shore to shore, and for 4,500 feet down the Channel, south, towards Morris' Ravine.

PRODUCTION AND VALUE OF GROUND.

The Spring Valley Canal and Mining Company, being the nearest neighbor claiming along the upper line, has worked within one hundred feet of said boundary line, as designated on the map, and developed in the progress of work richer gravel deposits than ever seen before at this place. This same company bought a piece of ground, being about 200x400 feet, from a certain John Welch, paying for this ground $31,800 in United States gold coin, at which price an acre would be worth a fraction over $17,000, when the yield per acre, according to the statistics of more than fifteen

years, would be from $60,000 to $80,000. But considering that all the mining operations at Cherokee Flat have been merely confined to the outskirts of the "lead," or what, in miner's parlance, is termed the "outside wash," and that, therefore, only the lighter particles of gold were reached; that, furthermore, and in support of this view, heavier and larger gold is reached as the channel deepens, and that, therefore, the yield increases and will increase for thousands of feet ahead, we must come to the conclusion that all the riches, so far developed, are nothing but a slight indication of what the future will disclose.

Throughout California, Cherokee Flat and the Table Mountain Lead are justly considered the richest gravel deposits in the State, and the closest investigation will confirm every statement made in this regard, and will show that the broad gravel stream enters, in its whole width, the boundary of the Cherokee Flat Blue Gravel Co.'s mining claim, and emerges again visibly at Morris' Ravine, directly south. Therefore, the existence of the "lead"—undoubtedly the main point—must be considered established, the more so when this "lead" shows itself in a thickness of from 300 to 400 feet, and in width of from one to two miles; and the next consideration must be:

How and by what means to work this "lead"?

TUNNEL AND INCLINE.

The answers to this question would be:

1. By a tunnel combining the three requisites mentioned, page 20, under 1, 2, 3.

2. By the introduction of a steady and sufficient stream of water—say 2,000 inches—procuring thus the means for extensive hydraulic operations; and

3. By drifting the richest part of the "blue lead"—the same way that stone-coal is extracted—and using in the drifts sluice boxes and water, instead of tramways and cars, to dispose of the ore, which *modus* would save the most expensive part of drift mining, the transportation of the ore, the different gravel deposits in the channel or basin, as well as the different tunnels entering the channel or basin, shows at once that the tunnel of the Cherokee Flat Blue Gravel Co. combines all the necessary requisites, and is destined to be the great outlet for the immense gravel deposit before us.

This tunnel, when reaching point A of the incline (800 feet from its present terminus), must be connected with the incline, either by a vertical shaft, or by a slope, interrupted here and there by terraces or benches, so that the gravel, rushing down this connection, receives the benefit of an additional crushing, which is so important that, in the most reputed gravel mines in this State, new tunnels are constructed with the single view to have them deep enough to admit of this crushing process.

The incline was constructed for the purpose of ascertaining the depth of the basin, so as to be a sure guide in the continuation of the tunnel, and, at the same time, to test the different gravel formations, which had to be cut diagonally, and proved, from the lighter quartz gravel down to the "rotten boulders" and blue gravel, identical with the already exposed part of the great gravel deposit.

This incline will be of the greatest advantage whenever a connection with the surface will have to be made for the purpose of commencing hydraulic operations, as the water can be introduced by pipes to the bottom of the incline, and there, under the greatest pressure, be used to wash the gravel through the then established connection between the incline and deep tunnel.

The upper quartz gravel, cut in the incline, and of which the main body of Table Mountain is composed, in a body of from 250 to 300 feet deep, consists altogether of quartz pebbles and quartz sand, and carries very fine particles of gold. The two lower strata, however, the "rotten boulders" and blue lead or gravel, are mixed, more or less, with different boulders, the former of clay slate, the latter of talc-slate. Both strata are very rich in gold, and average each from five to twenty-five feet in thickness.

The "rotten boulders," as they are called, on account of the softness of the boulders, have so far been the chief resources for gold at this place, as they were easily reached, lying above the "blue lead." This stratum seems to be peculiar to the Table Mountain deposit, and is not found in any other mining locality.

The Cherokee Mining Co., one of the oldest and most successful mining companies of this place, working, for want of a lower "outlet," altogether the "rotten boulders" and quartz gravel above them, and depending, so far, altogether on rain-water, collected in large reservoirs, produces from $80,000 to $100,000 every year, during the few rainy months. This company is now engaged to construct a large ditch from Butte Creek to the north-west of this place, and to carry it also by pipe over a wide and deep depression to Cherokee.

COST OF DITCH AND PIPE.

The Cherokee Flat Blue Gravel Co, with its advantages of an inexhaustible mine and an always sufficient tunnel, must now look to procure water from a source which will be adequate to the other favorable conditions; and here the North Fork of Feather river offers the surest, and therefore cheapest, supply.

The accompanying map gives a correct representation of the distances and elevations.

The projected ditch, though placed at random—that is, without special survey—may be estimated, approximately, as to distance and costs.

A former survey, the particulars of which are not at hand, placed the point to take the water from North Fork at Rock Creek, which, along the meanderings of

the river to the point on the north side of West Branch, where a pipe would have to be used, makes a distance of 27 miles. From this point to the discharge of water in the reservoir would need about three miles of pipe.

Timber for fluming, etc., is abundant; a portable saw-mill would supply what is wanted. The ditch must be commenced all along the line, but rapidly finished from the head-dam downward, so that it can be made the conveyance for sawed lumber, where such is needed for fluming, etc.

According to estimates of pretty reliable parties, who know the country well, $250,000 would be sufficient to build a ditch and a pipe able to supply 2,000 inches of running water, miner's measure, and one summer's time would suffice to do so.

Other expenses, as extension of tunnel and building of reservoir for hydraulic pipes, etc., can be covered with $50,000.

THE DIAMOND DRILL.

The new tunneling machine—the diamond drill—as it is now used in this country, at Smartsville, Nevada Co., and other places, has worked the greatest change in mining operations. This machine works in the hardest kind of trap rock from 3 to 5 feet, of a 6x7 foot tunnel, in 24 hours.

The rock in the Blue Gravel Co.'s tunnel can be worked at $20 per foot, by manual labor, and the diamond-drill machine would put the tunnel in readiness for operation in six months.

GENERAL CONSIDERATIONS.

The very favorable location of the Cherokee Flat Blue Gravel Co.'s mine would permit the washing of the upper gravel strata, without using a tunnel at all, by merely setting sluice boxes on the surface and washing the debris down into the valley below, a plan which will facilitate the mining operation beyond appreciation, not only by removing the danger arising from too high banks, but also by disposing of immense quantities of matter without overcharging the sluice boxes confined in the deeper tunnel, and reserving these latter for the more valuable material.

The Reservoir located to supply the hydraulic apparatus is 275 feet higher than the point of discharge, and the power thus created is immense.

Here is, then, an operation of which the result might be calculated to a mathematical truth. All depends on the steady supply of water, and the yield of the mines can be doubled and even quadrupled. The gold bearing material is here in inexhaustible and visible masses, and waits for the hand of energy to be turned to usefulness.

Closing this report, I must remark that the views and opinions discussed in

its beginning may be modified to each individual taste, but that the "facts" are stated under the firm impression of their unalterable truth.

CHARLES WALDEYER,
General Superintendent C. F. B. G. Co.

STATE OF CALIFORNIA, *County of Butte,* } ss.:

On this third day of October, A. D. one thousand eight hundred and seventy-one, before me, Jas. C. Martin, a notary public in and for said Butte county, duly commissioned and sworn, personally appeared Charles Waldeyer, of Cherokee Flat, Butte county, well known to me, who, first having been duly sworn upon his oath, declares, that the foregoing report made by him as the Superintendent of the Cherokee Flat Blue Gravel Company, is founded in fact and in all respects true, to the best of his knowledge and belief.

In witness whereof, I have hereunto set my hand and affixed my official seal, the day and year in this certificate first above written.

JAS. C. MARTIN.

The above report has my entire approval.

A. CASELLI,
President.

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